R19 RACK SYSTEMS

Installation & Operation Manual

SENS Manual P/N: 101323
Document Revision: B
DCN Number: 106877
Date: 10/19/2015

MADE IN U.S.A.

Installation or service questions?
Call SENS between 8 a.m. and 5 p.m. (Mountain Time),
Monday through Friday, or visit our website.

SENS®
STORED ENERGY SYSTEMS
1840 Industrial Circle
Longmont, CO 80501
Phone: 303.678.7500
800.742.2326
Fax: 303.678.7504
Email: service@sens-usa.com
Web: www.sens-usa.com

Copyright © Stored Energy Systems LLC 2015
The SENS name / logo are trademarks of Stored Energy Systems LLC

TABLE OF CONTENTS

1 DESCRIPTION AND SPECIFICATIONS 3
2 INSTALLATION INSTRUCTIONS 3
2.1. Installation Location and Handling 3
2.2. Electric Load Guidelines 4
2.3. Field Wiring Instructions 4
2.3.2.1. Return Bus Bar Wiring (Grounded) 5
2.3.2.2. Distribution Breaker Wiring (Ungrounded) 5
2.3.2.3. Distribution Auxiliary Wiring 6
2.4. Battery Installation 7
2.4.1. Battery Installation and Wiring Steps 8
3 OPERATING INSTRUCTIONS 11
3.1. Charger 11
3.2. Inverter 11
3.3. Distribution 11
4 MAINTENANCE AND REPAIR 11
4.1. Battery Maintenance 11
4.2. Charger Maintenance 11

1 DESCRIPTION AND SPECIFICATIONS

The configurable R19 product is a rack system consisting of various combinations of a charger, batteries, distribution breakers, and an inverter. Charger, distribution breakers, and inverter are ordered separately but are factory installed in the system by SENS. Batteries are also ordered separately and shipped with the system but field installation in the rack is required.

Table 1 – Specifications

	Feature
Rack	19 inches wide, 6ft. or 7ft. height models available, EIA-310 spacing
Input	See charger manual for AC input specifications
Output	12VDC negative grounded, 24VDC negative grounded, or 48VDC positive grounded models available (nominal values given)
	Charger (optional): 12-48VDC EnerGenius IQ charger. See charger manual for detailed output specifications.
	Distribution breakers (optional): allows for up to 10 single pole DC breakers. Breaker current ratings range from 15-100A. Inverter requires one distribution breaker slot if present.
	Auxiliary Switches: Each distribution breaker supplied with contacts for auxiliary signals. Auxiliary switches are S.P.D.T, rated for 3A at 50VDC, and include 0.110" male quick connect terminals.
Batteries (optional)	12V batteries, 0-3 battery trays, with or without string disconnects, select top or front battery terminals
Inverter (optional)	600W (optional on 12V, 24V, & 48V systems), configurable output for 100VAC +/-6% @ 6.0A, 117VAC +/-6% @ 5.1A, or 230VAC +/-6% @ 2.7A 1100W (optional on 24V & 48V systems), configurable output for 100VAC +/-6% @ 11.0A, 117VAC +/-6% @ 9.5A, or 230VAC +/-6% @ 4.8A
Operating Temperature	-20°C to 50° (-4° F to 122° F) normal operating range With optional Inverter: -20°C to +30°C full power operating range, de-rated 20% per 10°C above 30°C, +50°C maximum See battery manufacturer's ratings for additional temperature restrictions

2 INSTALLATION INSTRUCTIONS

INSTALLATION MUST COMPLY WITH ALL APPLICABLE LOCAL ELECTRICAL AND BUILDING CODES, AND BE MADE ACCORDING TO THE INSTALLATION INSTRUCTIONS AND APPLICABLE SAFETY REGULATIONS. ONLY TRAINED AND QUALIFIED PERSONNEL MAY INSTALL AND SERVICE THIS UNIT.

2.1. Installation Location and Handling

The R19 rack system is shipped on a wood pallet. Ship and store the rack system in an upright position on the pallet. Do not remove the rack system or any other equipment from pallet until the rack is transported to the installation location.

Refer to DIA\00633 (at back of manual) for dimensional, access and clearance information.

Locate the rack system in a controlled environment within the specified operating temperature range given in table 1. The rack system is designed to be floor mounted. Four mounting holes are provided at the bottom of the rack to accommodate ¾ inch anchoring bolts/studs. A clearance of 6 inches is

recommended on all sides and the top of the rack. Refer to DIA\00633 (at back of manual) for mounting details.

WARNING:
THE RACK SYSTEM IS DESIGNED FOR INSTALLATION IN CONTROLLED ENVIRONENTS WITH CONTROLLED ACCESS BY AUTHORIZONED PERSONEL ONLY. HAZARDOUS ENERGY IS PRESENT. CUSTOMER IS RESPONSIBLE TO ENSURE THAT BACK OF RACK SYSTEM IS NOT ACCESSIBLE.

PLEASE CONSULT LOCAL AUTHORITY AND APPLICABLE BUILDING CODES FOR ALL INSTALLATION DETAILS OF THIS SYSTEM.

2.2. Electric Load Guidelines

If battery string disconnect breakers are not present, the maximum simultaneous sum of all loads connected to the distribution panel may not exceed 100A.

If battery string disconnect breakers are present, the maximum simultaneous sum of all loads connected to the distribution panel may not exceed 80A (80% of 100A rated breaker) per battery string. See table 2.

Table 2 – Electric Load Limitations

Battery String Configuration	Maximum Simultaneous System Load
No string disconnect breakers	100A
1 battery string with string disconnect breakers	80A
2 battery strings with string disconnect breakers	160A
3 battery strings with string disconnect breakers	240A

2.3. Field Wiring Instructions

Field wiring connections are made to the charger, distribution panel, inverter, and ground lug. All wiring and wiring terminals are to be installed in accordance with the applicable electrical code. All cables must be protected from mechanical strain. Ensure wiring terminals are installed with 1/2 inch minimum spacing to conductive surfaces. Do not remove installed insulators of the distribution panel.

SWITCH ALL BREAKERS (CHARGER, DISTRIBUTION, AND BATTERY STRING) TO OFF BEFORE INSTALLING FIELD WIRING

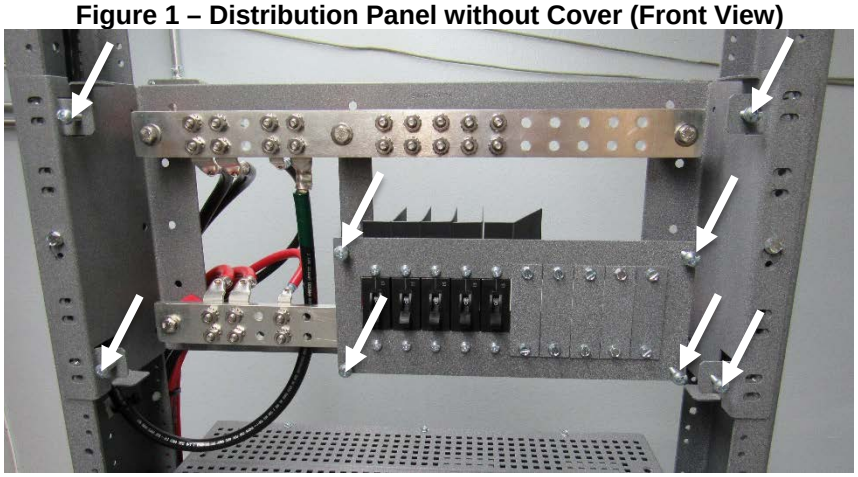
2.3.1. Input Wiring

Connect input wiring to charger input breaker terminals. See charger manual for input wiring specifications.

2.3.2. Distribution Wiring

Distribution wiring is terminated directly to the return bus bar and the distribution breakers. Size the distribution wiring according to the size of the load and distribution breaker. For better access to wiring terminals, the front cover can be removed from the distribution panel by removing the eight screws (shown in Figure 1) on the front of the cover.

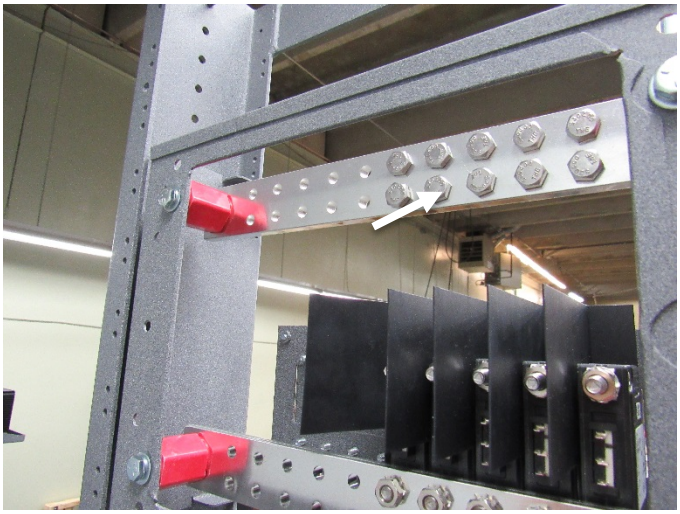
Figure 1 – Distribution Panel without Cover (Front View)



2.3.2.1. Return Bus Bar Wiring (Grounded)

The return (grounded) bus bar is located at the top of the panel. It is the bus bar without breakers. The return bus bar is provided with 0.250 inch clearance holes on 0.625 inch centers intended for installation with double-hole 90° crimp lugs (Panduit type LCDXZ-14AF recommended, where Z=gauge). The bus bar accepts wire sizes of 8-2 AWG. Nuts and bolts are factory installed. Torque return bus bar connections (1/4-20 hardware) to 45 in-lbs.

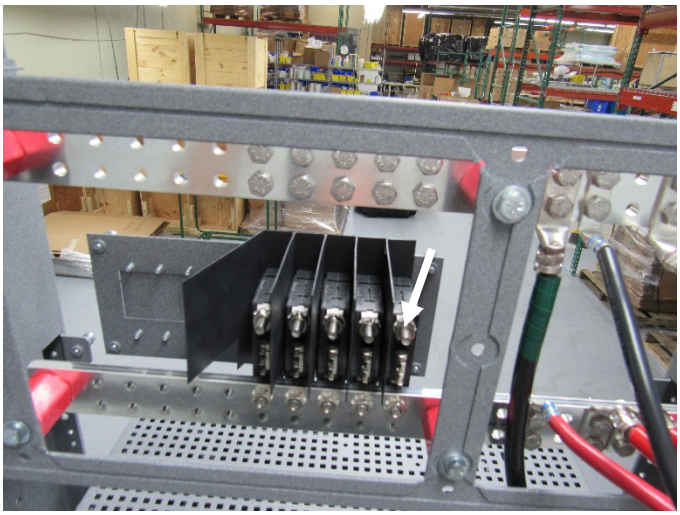
Figure 2 – Return (grounded) Connections



2.3.2.2. Distribution Breaker Wiring (Ungrounded)

Each distribution breaker is provided with a 1/4-20 stud for field termination. Attachment hardware is factory provided. This connection is intended for installation with single-hole 90° crimp lugs (Panduit type LCAXZ-14F recommended, where Z=gauge). The distribution breaker accepts wire sizes of 8-2 AWG. Torque breaker stud connection (1/4-20 hardware) to 45 in-lbs.

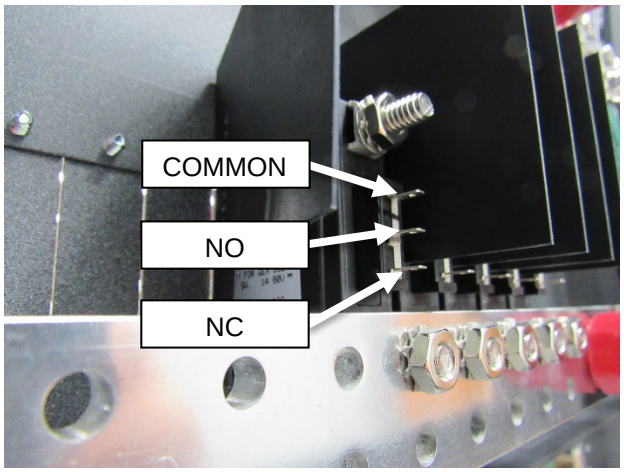
Figure 3 – Distribution (ungrounded) Connection



2.3.2.3. Distribution Auxiliary Wiring

Each distribution breaker is provided with contacts for auxiliary connections. Each auxiliary switch is S.P.D.T (1 NC, 1 NO), and is rated for 3A at 50VDC. Each contact is a 0.110" quick connect terminal. Use appropriate wiring and terminals. Ensure terminals are insulated to ensure spacing requirements are met. Ensure proper spacing to bus bars to ensure no shorts occur.

Figure 4 – Distribution Auxiliary Contacts



2.3.3. Inverter Wiring

If an inverter is present, see inverter manual for inverter output wiring. Inverter DC input and ground wiring is factory installed.

2.3.4. Ground Lug Wiring

Connect the system grounding conductor to the ground lug, located at the top inner surface of the right upright. The lug accepts Class B and C wire size 14-2/0 AWG and Class G-K wire size 14-1/0 AWG. Tighten connections as described in Table 3.

Figure 5 – Ground Lug Connection

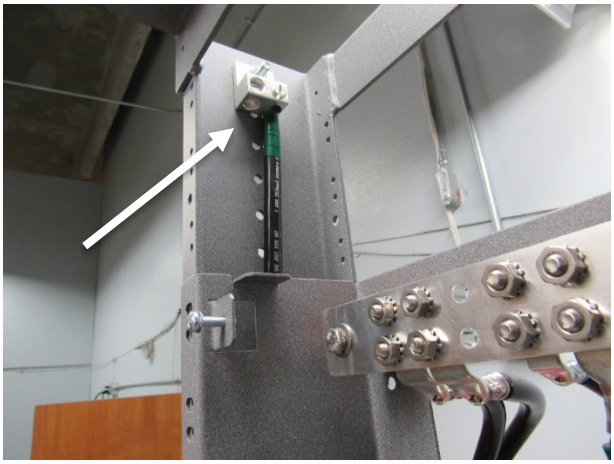


Table 3 – Ground Lug Tightening Torque

Wire Size (Class B&C)	Wire Size (Class G-K)	Tightening Torque
	1-1/0	75in-lbs (8.5 Nm)
	4-1	55in-lbs (6.2 Nm)
3-2/0	8-4	50in-lbs (5.6 Nm)
6-4	10-8	45in-lbs (5.1 Nm)
8	14-10	40in-lbs (4.5 Nm)
14-10	N/A	35in-lbs (4.0 Nm)

2.3.5. Additional Breakers

Additional locations are available to add breakers in the field if desired. Contact SENS to order additional breakers. Separately ordered breakers from SENS include hardware and insulators.

2.4. Battery Installation

WARNING:
BATTERY POWER SYSTEMS PROVIDE ELECTRICAL VOLTAGE AND AMPERAGE LEVELS THAT ARE CONSIDERED ELECTRICAL HAZARDS. ONLY QUALIFIED PERSONNEL SHOULD INSTALL, OPERATE, AND SERVICE THIS EQUIPMENT. USE APPROPRIATE INSTALLATION METHODS INCLUDING USING ONLY INSULATED TOOLS. REMOVE ALL JEWELRY AND WATCHES BEFORE INSTALLATION.

ENSURE THAT ALL BATTERY CABLE TERMINALS ARE INSULATED FROM THE RACK ASSEMBLY PRIOR TO POWERING CHARGER OR CONNECTING BATTERIES.

Due to shipping requirements, batteries are shipped on the pallet base of the R19 systems. The batteries must be installed in the field. Before unpacking the battery blocks, note the system voltage from the rack system label. Each battery shelf is intended to contain a single unique battery string. Each string has the same voltage as the system voltage. When multiple shelves are present, each battery string (one per shelf) is factory connected in parallel at the distribution panel bus bars. The battery string cables connecting the distribution panel to batteries, are factory installed and are to be terminated to the batteries in the field. The interconnect cables required to connect the batteries in a battery string are included on the rack pallet (when required).

SWITCH ALL BREAKERS (CHARGER, DISTRIBUTION, AND BATTERY STRING) TO OFF BEFORE INSTALLING BATTERIES

2.4.1. Battery Installation and Wiring Steps

1. See Figures 6 and 7 for example battery installations.
2. See Figure 8 for battery layout configurations.
3. Place batteries on shelve(s), ensuring proper placement to achieve system voltage (each battery shelf contains a unique battery string and multiple shelves are connected in parallel).
4. The battery shelves are provided with slots for use with customer-supplied battery securing straps. Secure batteries as needed depending on installation parameters.
5. Verify that all terminals of the battery cables are insulated. Ensure continued proper insulation of all terminals during battery installation.
6. Connect the hot/ungrounded supply wire to the hot/ungrounded terminal of the first battery. Note that the ground reference depends on the system configuration. The lower bus bar of the distribution panel is the hot/ungrounded bus. If the system has multiple battery strings, connect the other hot/ungrounded supply wires.
7. Connect the return/ground wires to the return/ground terminal of the last battery. Note that the ground reference depends on the system configuration. The upper bus bar of the distribution panel is the return/ground bus. If the system has multiple battery strings, connect the other return/ground wires.

   CAUTION:
   IF MULTIPLE BATTERY STRINGS ARE PRESENT AND THERE ARE NO STRING DISCONNECTS, ALL THE OPEN RETURN/GROUND WIRES ARE LIVE. ENSURE PROPER INSULATION OF ALL CABLE TERMINALS.

8. Connect batteries together using the interconnect cables supplied. Verify all battery connections for proper order and terminal polarity, per Figure 8.
9. Ensure all battery terminals are protected with factory supplied covers.
10. Torque all battery cables and connections as specified on the battery label.

Figure 6 – Battery Wiring Example (Top Terminal)

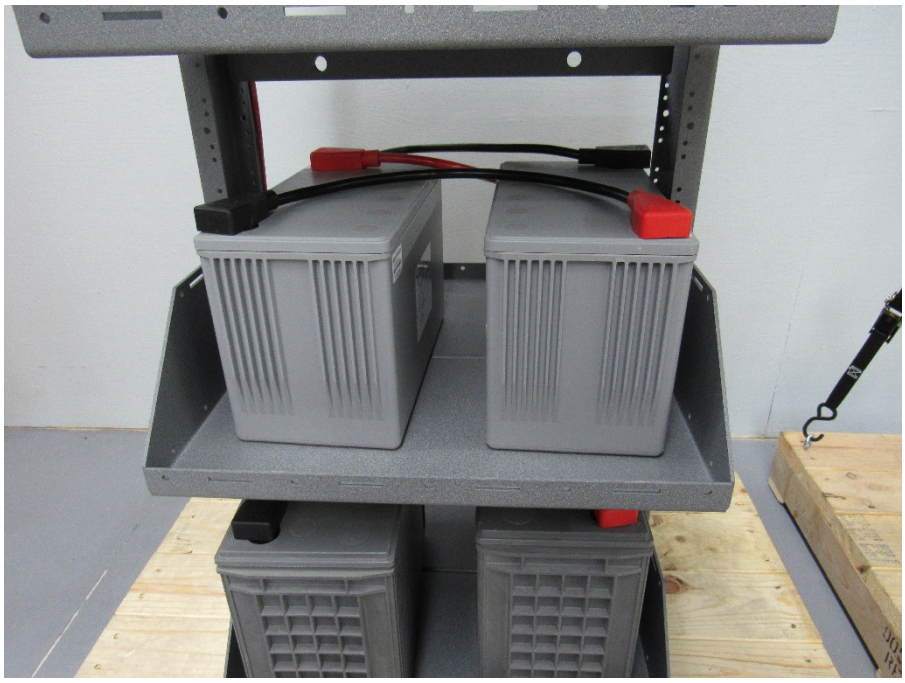
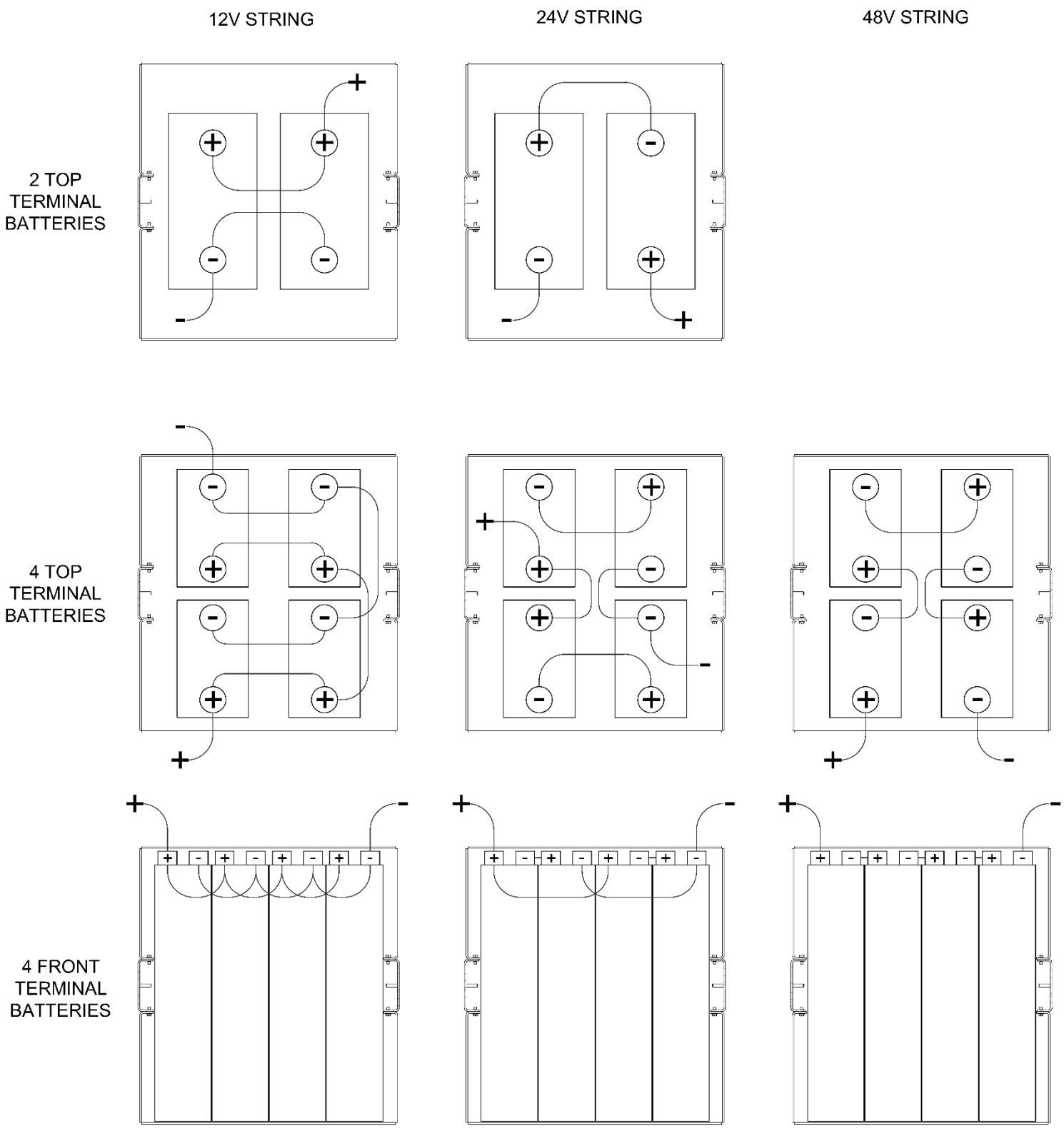


Figure7 – Battery Wiring Example (Front Terminal)

Figure 8 – Battery Layout Wiring



3 OPERATING INSTRUCTIONS

WARNING:
COMPONENTS WITHIN THIS SYSTEM MAY BE ENERGIZED AT HIGH VOLTAGE POTENTIALS. DO NOT TOUCH EXPOSED LIVE METAL SURFACES WHILE POWER IS APPLIED. THE RACK SYSTEM SHOULD ONLY BE ACCESSED, OPERATED, AND SERVICED BY TRAINED AND QUALIFIED PERSONNEL.

DANGER:
TURN OFF CHARGER BEFORE DISCONNECTING BATTERY CABLES. DISCONNECT ALL BATTERIES BEFORE SERVICING. USE APPROPRIATE METHODS INCLUDING USING ONLY INSULATED TOOLS. REMOVE ALL JEWELRY AND WATCHES BEFORE SERVICING.

3.1. Charger

See charger manual for charger operating instructions.

3.2. Inverter

See inverter manual for inverter operating instructions.

3.3. Distribution

Operate breaker handles as required for given installation. Ensure electric load requirements are met as described in Section 2.3.

4 MAINTENANCE AND REPAIR

4.1. Battery Maintenance

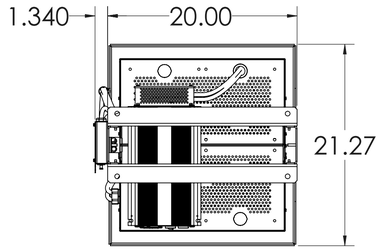
Follow the battery manufacturer's guidelines on maintenance, service, and replacement of batteries.

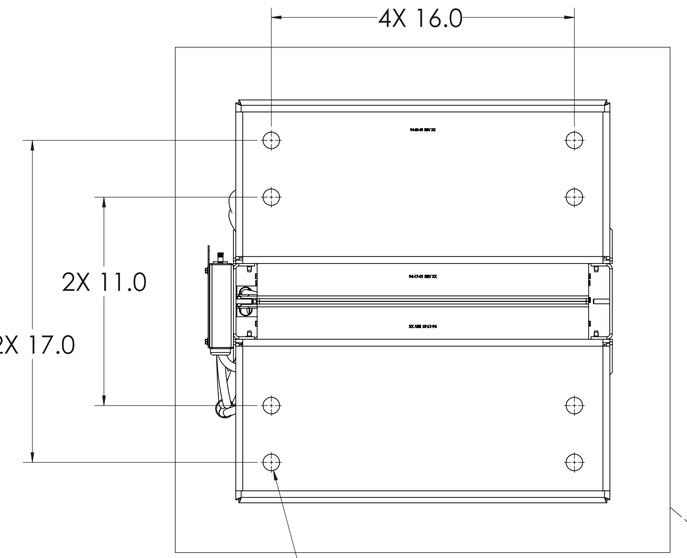
4.2. Charger Maintenance

a. Annually: Check all field wiring connections for electrical and mechanical integrity, verifying no corrosion or loose hardware is present
b. Annually: Verify that convection cooling vents are not blocked or clogged
c. Every 10 years: If the charger is typically operated at ambient temperatures above 30°C (86°F), replace the filter capacitors. Regardless of ambient temperatures, replace the filter capacitors if high charger output ripple is not desired.

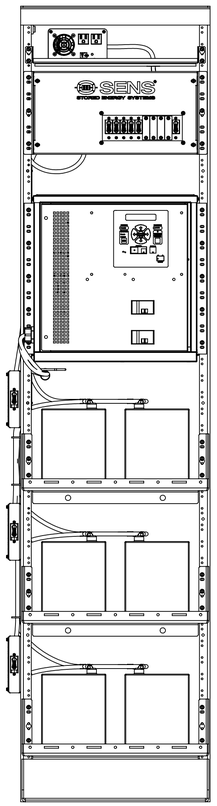
NOTES:
1. THE INSTALLATION OF THIS EQUIPMENT SHALL COMPLY WITH ALL LOCAL AUTHORITY AND APPLICABLE BUILDING CODES.
2. THE RACK SYSTEM IS DESIGNED FOR INSTALLATION IN CONTROLLED ENVIRONENTS WITH CONTROLLED ACCESS BY AUTHORIZONED PERSONEL ONLY. HAZARDOUS ENERGY IS PRESENT. CUSTOMER IS RESPONSIBLE TO ENSURE THAT BACK OF RACK SYSTEM IS NOT ACCESSIBLE.
3. PROVIDE A MINIMUM OF 6IN OF CLEARANCE SPACE ON SIDES AND TOP OF RACK SYSTEM.
4. HEIGHT AND WEIGHT OF RACK SYSTEM MAY VARY. SEE SPECIFIC SYSTEM DETAILS.

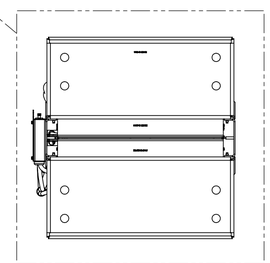
REVISIONS				
DCN	REV	DESCRIPTION	DATE	APPROVED
106857	A	INITIAL RELEASE	8/17/2015	ERS

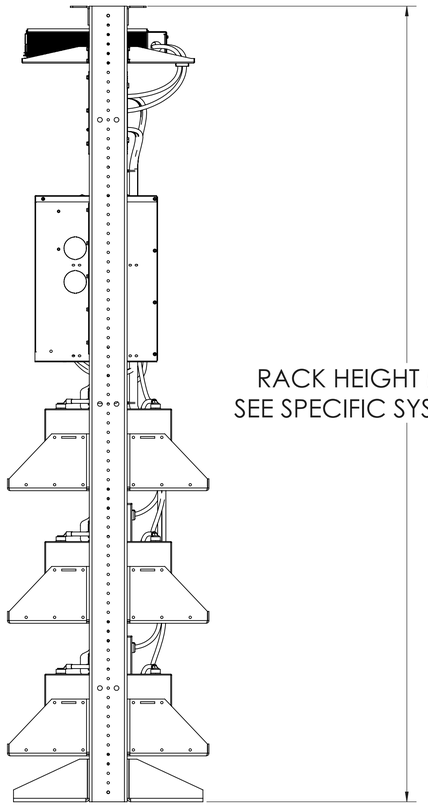




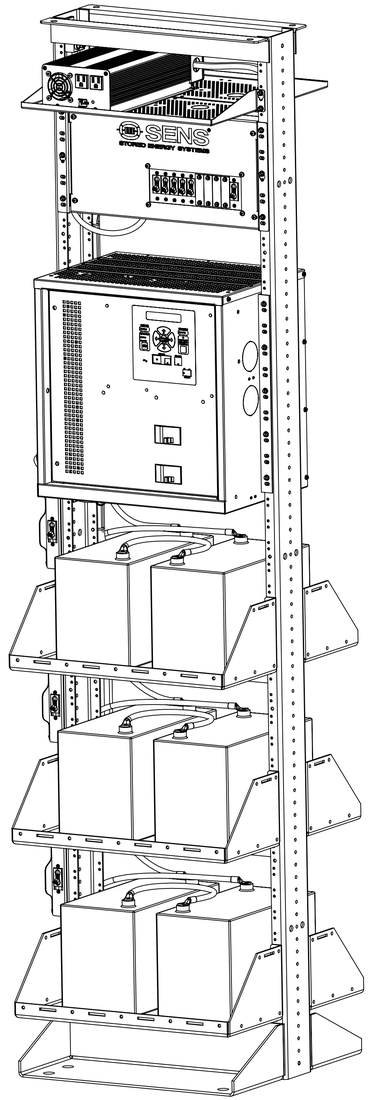
DETAIL A
BOTTOM VIEW
SCALE 1 : 4







RACK HEIGHT MAY VARY
SEE SPECIFIC SYSTEM DETAILS



SENS
STORED ENERGY SYSTEMS
1840 INDUSTRIAL CIRCLE
LONGMONT, CO 80501
303-678-7500
WWW.SENS-USA.COM
PROPRIETARY AND CONFIDENTIAL
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF STORED ENERGY SYSTEMS, LLC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF STORED ENERGY SYSTEMS, LLC. IS PROHIBITED.

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN **INCHES**
DEFAULT TOLERANCES:
ANGLES ± 1°
TWO PLACE DECIMAL ± .02
THREE PLACE DECIMAL ± .005
DO NOT SCALE DRAWING

	NAME	DATE
DRAWN	ERS	8/17/2015
CHECKED		

THIRD ANGLE PROJECTION
DIMENSIONS & TOLERANCES PER ASME Y14.5 - 2009

DESCRIPTION: DIAGRAM,R19,MOUNTING

SIZE: D
DOCUMENT NUMBER: DIA\00633
REV: A
SHEET 1 OF 1